

**REMARKS**

Claims 1-19 are all the claims presently pending in the application. Claims 1-12 have been merely editorially amended and have not been substantively amended. Claims 13-19 have been added to claim additional features of the invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicants specifically state that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claim 5 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1-4 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Japanese Patent Publication No. 11-029836 (hereinafter JP '836) or Iguchi et al. (U.S. Patent No. 6,270,596; hereinafter "Iguchi"). Claims 5-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '836 or Iguchi.

These rejections are respectfully traversed in the following discussion.

**I. THE CLAIMED INVENTION**

The claimed invention of exemplary claim 1 provides a steel for use in a high strength pinion shift wherein  $0.80 < C_{eq} < 0.95$  and wherein  $f \text{ value} \leq 1.0$  (e.g., see Application at page 6, line 20 through page 7, line 11). These features are important for providing a steel for use in a high strength pinion shaft which is not refined and used by high frequency hardening, with less occurrence of peeling upon hobbing, having higher surface hardness and impact value and torsional strength after high frequency hardening, and with less heat treatment strains (see Application at page 5, lines 5-12).

## **II. THE 35 U.S.C. 112, SECOND PARAGRAPH, REJECTION**

The Examiner has rejected claim 5 under 35 U.S.C. 112, second paragraph, as being indefinite. Specifically, the Examiner alleged that the term “tissue” is indefinite because tissue is not a metallurgical term known in the art.

In order to expedite prosecution of the Application, Applicants have amended claim 5 to replace the term “tissue” with the term “steel” to overcome the Examiner’s rejection.

Therefore, the Examiner is respectfully requested to reconsider and withdraw this rejection.

## **III. PRIOR ART REFERENCES**

### **A. The JP ‘836 Reference**

The Examiner alleges that JP ‘836 teaches the claimed invention of claims 1-4. Furthermore, the Examiner alleges that the claimed invention of claims 5-12 would have been obvious in view of JP ‘836. Applicants submit, however, that JP ‘836 does not teach or suggest (nor make obvious) each and every feature of the claimed invention.

That is, JP ‘836 does not teach or suggest a steel for use in a high strength pinion shaft “*wherein  $0.80 \leq Ceq \leq 0.95$* ” and “*wherein  $f value \leq 1.0$* ” as recited in claim 1 and similarly recited in claims 5 and 9.

The Examiner attempts to rely on Steel 7 in Table 1 of JP ‘836 to support his allegation. The Examiner, however, is clearly incorrect.

That is, nowhere in this table (nor anywhere else for that matter) does JP ‘836 teach or suggest a steel for use in a high strength pinion shaft wherein  $0.80 \leq Ceq \leq 0.95$  and wherein  $f value \leq 1.0$ . Indeed, the Examiner does not even allege that JP ‘836 teaches or suggests these features.

The Examiner merely alleges that “even though prior art does not teach the claimed equations, such would not be a patentable difference because it has been held that there is no invention involved in the discovery of a general formula if it covers a composition described in the prior art” (see Office Action dated June 30, 2005 at page 2, numbered paragraph 3). Applicants disagree with the Examiner’s allegation.

That is, Applicants point out that the limitations recited in exemplary claim 1 (i.e., wherein  $0.80 \leq C_{eq} \leq 0.95$  and wherein  $f \text{ value} \leq 1.0$ .) are not “general formulas” as alleged by the Examiner. The claimed ranges for the values of  $C_{eq}$  and  $f$  are specific parameters of the claimed invention that are distinct from the mass percentage values recited for each component of the steel composition.

Furthermore, Applicants point out that M.P.E.P. §2144.05 states that “[t]he law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims.” Furthermore, a particular range or other variable in a claim may provide patentable weight to a claim if the applicant can show that the particular range is important (see M.P.E.P. §2144.05). In order to anticipate these claimed parameter ranges, the specific limitations must be disclosed in the applied reference with “sufficient specificity to constitute an anticipation under the statute” (see M.P.E.P. §2131.03). JP ‘836 does not even mention a value for  $C_{eq}$  or a  $f$  value, let alone teach or suggest the specific value ranges recited in claim 1, and similarly in claims 5 and 9.

Applicants submit that they have discovered specific value ranges for  $C_{eq}$  and  $f$  value that achieve recognized results. That is, the claimed value ranges recited in exemplary claim 1 (and similarly claims 5 and 9) are important for achieving the desired results of the claimed invention.

Applicants have discovered that the hardness of the steel is substantially determined by the magnitude of  $C_{eq}$ . That is, for achieving the desired hardness for the steel to be used

in a pinion shaft (e.g., a hardness of 24-30 HRC), it is important that the  $C_{eq}$  value is in a range from 0.80 to 0.95. This is because the hardness of the steel after hot rolling is not 25 HRC or more when the  $C_{eq}$  value is less than 0.80. However, when the value of  $C_{eq}$  is larger than 0.95 the hardness of the steel increases excessively to greater than 30 HRC, which lowers the machinability of the steel (see Application at page 16, lines 9-17).

Additionally, as further evidenced by the results depicted in Table 2 of the Application, in Comparative Example 3, in which  $C_{eq}$  was lower than that of the claimed invention (i.e.,  $C_{eq}$  value = 0.68) the ferrite area ratio was larger than that in the examples of the claimed invention (see Application at Table 2). Additionally, the surface hardness after high frequency hardening was lower than that of the claimed invention and peeling in hobbing and tooth form strain by high frequency hardening were also larger than those in the examples of the claimed invention.

Furthermore, Applicants have discovered that the amount of ferrite in the steel is substantially determined depending on the magnitude of the  $f$  value. That is, for achieving the desired amount of ferrite (e.g., amount of ferrite is 40% or less) for the steel to be used in a pinion shaft, it is important that the  $f$  value is 1.0 or less. This is because when the  $f$  value exceeds 1.0 the amount of ferrite in the steel cannot be maintained at 40% or less (see Application at page 17, lines 6-13). It is important to limit the amount of ferrite because remaining ferrite lowers the bending and torsional strength of the steel as well as deteriorates the wear resistance of the steel (see Application at page 18, lines 2-9).

Additionally, as further evidenced by the results depicted in Table 2 of the Application, in Comparative Example 1, in which the  $f$  value was higher than that of the claimed invention, the ferrite area ratio was larger than that in the examples of the claimed invention (see Application at Table 2). Additionally, the peeling in hobbing and tooth form

strain by high frequency hardening were also larger than those in the examples of the claimed invention.

Therefore, the specific limitations recited in exemplary claim 1 (and similarly claims 5 and 9) clearly show a technical effect and are not arbitrarily selected to solve the problems of the claimed invention. Therefore, the Examiner must point out where these claimed ranges are taught in JP '836.

Even assuming, however, that the Examiner alleges that the claimed range of the value for  $C_{eq}$  and  $f$  value is obvious in view of JP '836, Applicants point out that the M.P.E.P. provides that "[a] particular parameter must first be recognized as a result-effective variable, i.e., **a variable which achieves a recognized result**, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation" (see M.P.E.P. §2144.05) (emphasis added). Here, JP '836 does not suggest any result as being affected by the magnitude of  $C_{eq}$  or  $f$  value in the steel, let alone optimizing a magnitude of  $C_{eq}$  or  $f$  value for providing the desired results of the claimed invention.

That is, nowhere does JP '836 teach or suggest that the magnitude of  $C_{eq}$  in steel may have any effect on the hardness of the steel after hot rolling. Nor does JP '836 teach or suggest that the  $f$  value of steel may have any effect on the amount of ferrite in steel. Therefore, it is completely unreasonable to suggest that JP '836 teaches or suggests that a magnitude of  $C_{eq}$  or  $f$  value are merely result-effective variables.

Moreover, JP '836 is merely related to the axial parts represented by the drive shaft, but in stark contrast, the Application is related to the steel for pinion shaft for a different use.

Additionally, the chemical components in JP '836 are not defined by carbon equivalence ( $C_{eq}$ ) and  $f$  value as in the claimed invention. Although in JP '836, chemical components are defined by formula, this is for characterizing anti-quenching crack property.

In the claimed invention, the purpose is to improve the properties for the function of the pinion shaft. Therefore, both the purpose and formula of JP '836 are different from that of the claimed invention.

Therefore, Applicants submit that JP '836 does not teach or suggest each and every feature of the claimed invention. Therefore, the Examiner is respectfully requested to reconsider and withdraw this rejection.

#### **B. The Iguchi Reference**

The Examiner alleges that Iguchi teaches the claimed invention of claims 1-4. Furthermore, the Examiner alleges that the claimed invention of claims 5-12 would have been obvious in view of Iguchi. Applicants submit, however, that Iguchi does not teach or suggest (nor make obvious) each and every feature of the claimed invention.

That is, Iguchi does not teach or suggest a steel for use in a high strength pinion shaft “*wherein  $0.80 \leq Ceq \leq 0.95$* ” and “*wherein  $f \text{ value} \leq 1.0$* ” as recited in claim 1 and similarly recited in claims 5 and 9.

The Examiner attempts to rely on Steel 7 in Table 1 of Iguchi to support his allegation. The Examiner, however, is clearly incorrect.

That is, nowhere in this table (nor anywhere else for that matter) does Iguchi teach or suggest a steel for use in a high strength pinion shaft wherein  $0.80 < Ceq \leq 0.95$  and wherein  $f \text{ value} \leq 1.0$ . Indeed, the Examiner does not even allege that Iguchi teaches or suggests these features.

The Examiner merely alleges that “even though prior art does not teach the claimed equations, such would not be a patentable difference because it has been held that there is no invention involved in the discovery of a general formula if it covers a composition described

in the prior art” (see Office Action dated June 30, 2005 at page 2, numbered paragraph 3).

The Examiner, however, is clearly incorrect.

That is, Applicants point out that the limitations recited in exemplary claim (i.e., wherein  $0.80 \leq Ceq \leq 0.95$  and wherein  $f \text{ value} \leq 1.0$ .) are not “general formulas” as alleged by the Examiner. The claimed ranges for the values of  $Ceq$  and  $f$  are specific parameters of the claimed invention that are distinct from the mass percentage values recited for each component of the steel composition.

Furthermore, Applicants point out that M.P.E.P. §2144.05 states that “[t]he law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims.” Furthermore, a particular range or other variable in a claim may provide patentable weight to a claim if the applicant can show that the particular range is important (see M.P.E.P. §2144.05). In order to anticipate these claimed parameter ranges, the specific limitations must be disclosed in the applied reference with “sufficient specificity to constitute an anticipation under the statute” (see M.P.E.P. §2131.03). Iguchi does not even mention a value for  $Ceq$  or a  $f$  value, let alone teach or suggest the specific value ranges recited in claim 1, and similarly in claims 5 and 9.

Applicants respectfully submit that Applicants have discovered specific value ranges for  $Ceq$  and  $f$  value that achieve recognized results. That is, the claimed value ranges recited in exemplary claim 1 (and similarly claims 5 and 9) are important for achieving the desired results of the claimed invention.

Applicants have discovered that the hardness of the steel is substantially determined by the magnitude of  $Ceq$ . That is, for achieving the desired hardness for the steel to be used in a pinion shaft (e.g., a hardness of 24-30 HRC), it is important that the  $Ceq$  value is in a range from 0.80 to 0.95. This is because the hardness of the steel after hot rolling is not 25 HRC or more when the  $Ceq$  value is less than 0.80. However, when the value of  $Ceq$  is

larger than 0.95 the hardness of the steel increases excessively to greater than 30 HRC, which lowers the machinability of the steel (see Application at page 16, lines 9-17).

Additionally, as further evidenced by the results depicted in Table 2 of the Application, in Comparative Example 3, in which  $C_{eq}$  was lower than that of the claimed invention (i.e.,  $C_{eq}$  value = 0.68) the ferrite area ratio was larger than that in the examples of the claimed invention (see Application at Table 2). Additionally, the surface hardness after high frequency hardening was lower than that of the claimed invention and peeling in hobbing and tooth form strain by high frequency hardening were also larger than those in the examples of the claimed invention.

Furthermore, Applicants have discovered that the amount of ferrite in the steel is substantially determined depending on the magnitude of the  $f$  value. That is, for achieving the desired amount of ferrite (e.g., amount of ferrite is 40% or less) for the steel to be used in a pinion shaft, it is important that the  $f$  value is 1.0 or less. This is because when the  $f$  value exceeds 1.0 the amount of ferrite in the steel cannot be maintained at 40% or less (see Application at page 17, lines 6-13). It is important to limit the amount of ferrite because remaining ferrite lowers the bending and torsional strength of the steel as well as deteriorates the wear resistance of the steel (see Application at page 18, lines 2-9).

Additionally, as further evidenced by the results depicted in Table 2 of the Application, in Comparative Example 1, in which the  $f$  value was higher than that of the claimed invention, the ferrite area ratio was larger than that in the examples of the claimed invention (see Application at Table 2). Additionally, the peeling in hobbing and tooth form strain by high frequency hardening were also larger than those in the examples of the claimed invention.

Therefore, the specific limitations recited in exemplary claim 1 (and similarly claims 5 and 9) clearly show a technical effect and are not arbitrarily selected to solve the problems



of the claimed invention. Therefore, the Examiner must point out where these claimed ranges are taught in Iguchi.

Even assuming, however, that the Examiner alleges that the claimed range of the value for  $C_{eq}$  and  $f$  value is obvious in view of Iguchi, Applicants point out that the M.P.E.P. provides that “[a] particular parameter must first be recognized as a result-effective variable, i.e., **a variable which achieves a recognized result**, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation” (see M.P.E.P. §2144.05) (emphasis added). Here, Iguchi does not suggest any result as being affected by the magnitude of  $C_{eq}$  or  $f$  value in the steel, let alone optimizing a magnitude of  $C_{eq}$  or  $f$  value for providing the desired results of the claimed invention.

That is, nowhere does Iguchi teach or suggest that the magnitude of  $C_{eq}$  in steel may have any effect on the hardness of the steel after hot rolling. Nor does Iguchi teach or suggest that the  $f$  value of steel may have any effect on the amount of ferrite in steel. Therefore, it is completely unreasonable to suggest that Iguchi teaches or suggests that a magnitude of  $C_{eq}$  or  $f$  value are merely result-effective variables.

Moreover, Iguchi is merely related to high strength steel for a drive shaft and teaches a different use of the steel for pinion shaft of the claimed invention. Additionally, the chemical components are not defined by carbon equivalence ( $C_{eq}$ ) and  $f$  value as in this application.

Concerning the production method, the area reduction rate is higher than 30% according to Iguchi but according to this application it is higher than 10%.

Finally, although Iguchi gives greater importance to the properties of the shaft, the claimed invention provides a shaft and gear with excellent properties simultaneously.

Therefore, Applicants submit that Iguchi does not teach or suggest each and every feature of the claimed invention. Therefore, the Examiner is respectfully requested to reconsider and withdraw this rejection.

#### **IV. NEW CLAIMS**

New claims 13-19 have been added to provide more varied protection for the claimed invention and to claim additional features of the invention. These claims are independently patentable because of the novel features recited therein.

Applicants submit that new claims 13-19 are patentable over any combination of the applied references at least for analogous reasons to those set forth above with respect to claims 1-12.

#### **IV. FORMAL MATTERS AND CONCLUSION**

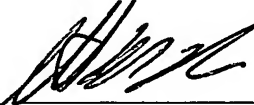
In view of the foregoing, Applicants submit that claims 1-19, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: September 30, 2005



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